

Jet Propulsion Laboratory
California Institute of Technology

The ASPIRE Project

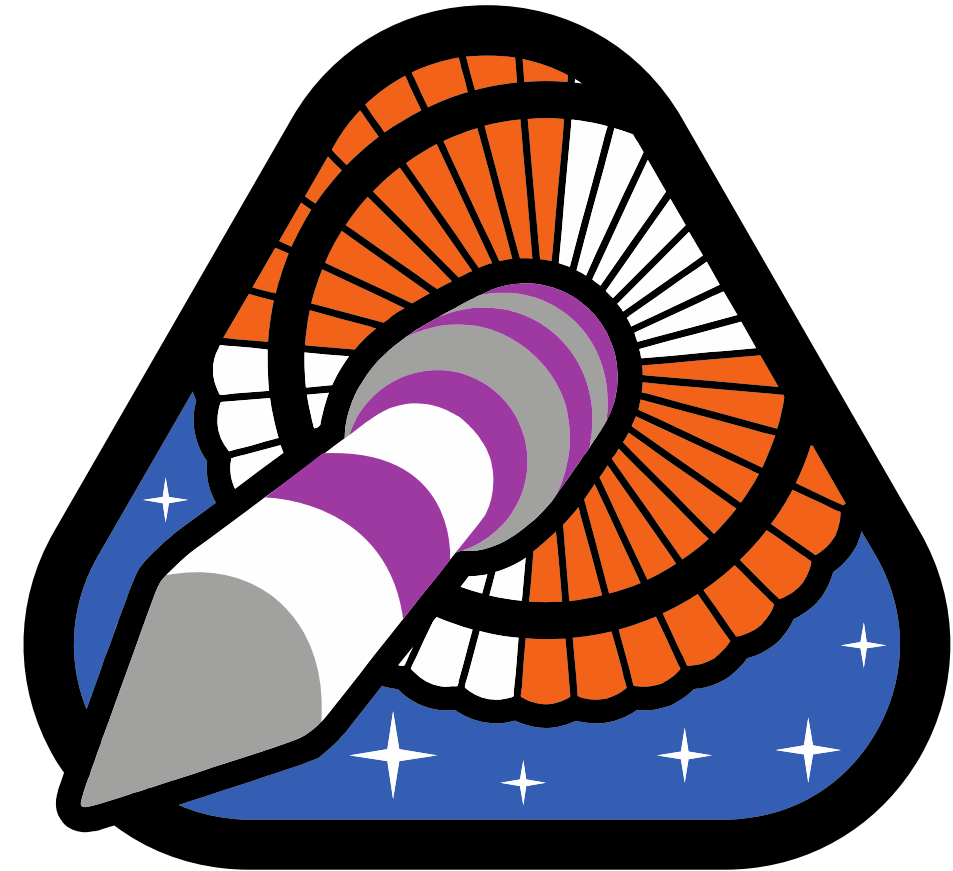
UBC MECH 329

Monday November 20, 2017

Clara O'Farrell

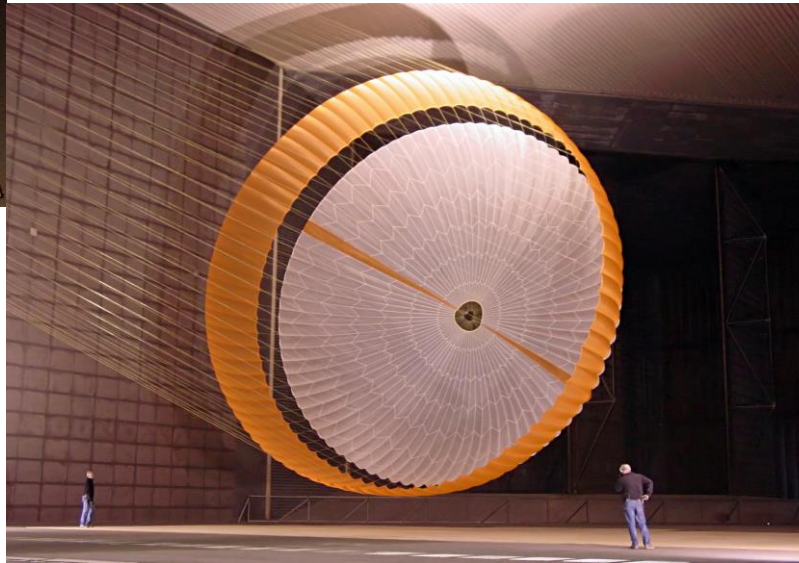
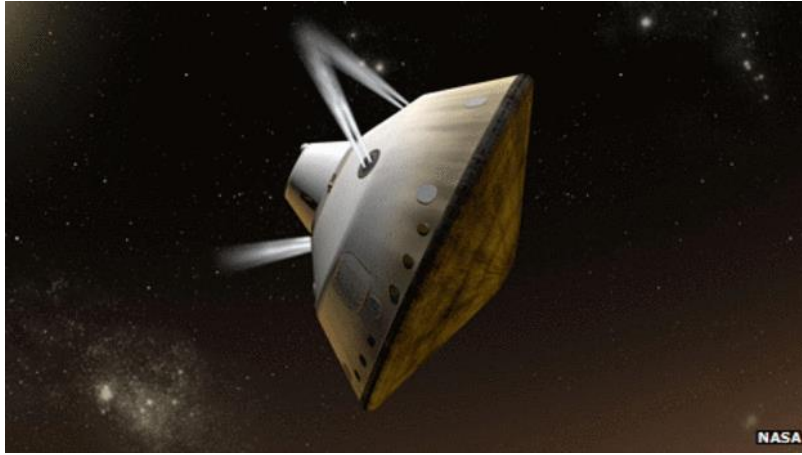
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ASPIRE

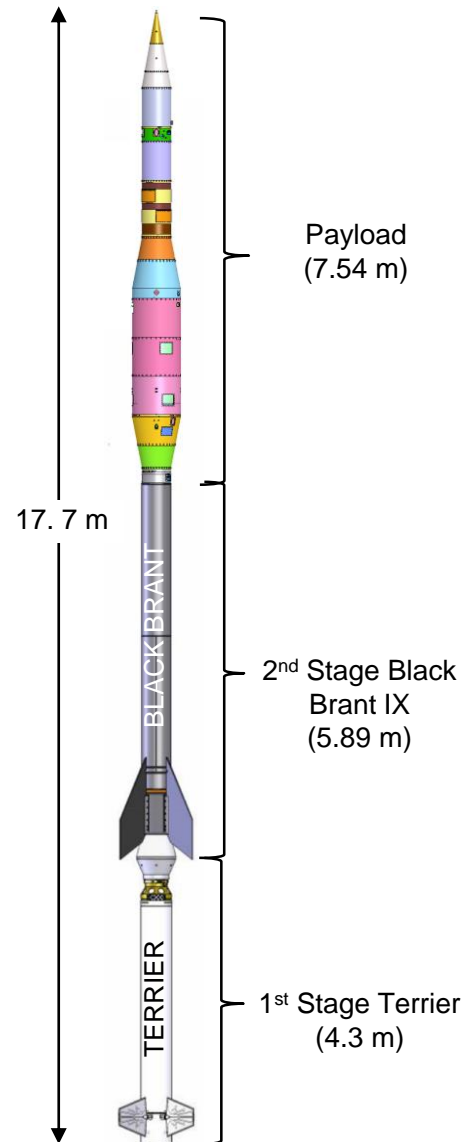
Mars Entry, Descent & Landing



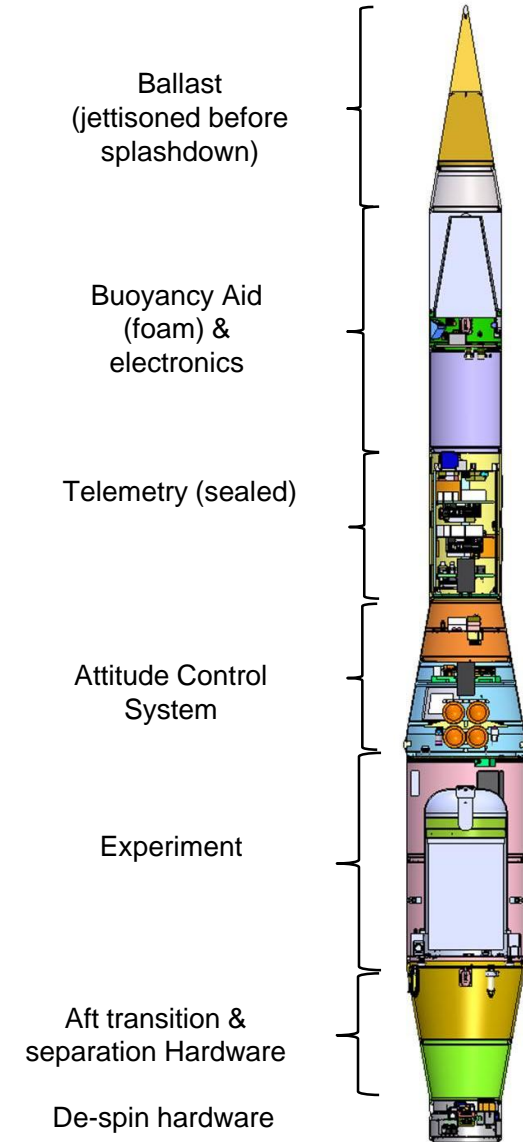
The **Advanced Supersonic Parachute Inflation Research Experiment (ASPIRE)** is testing the 21.5-m parachute for NASA's Mars 2020 rover.



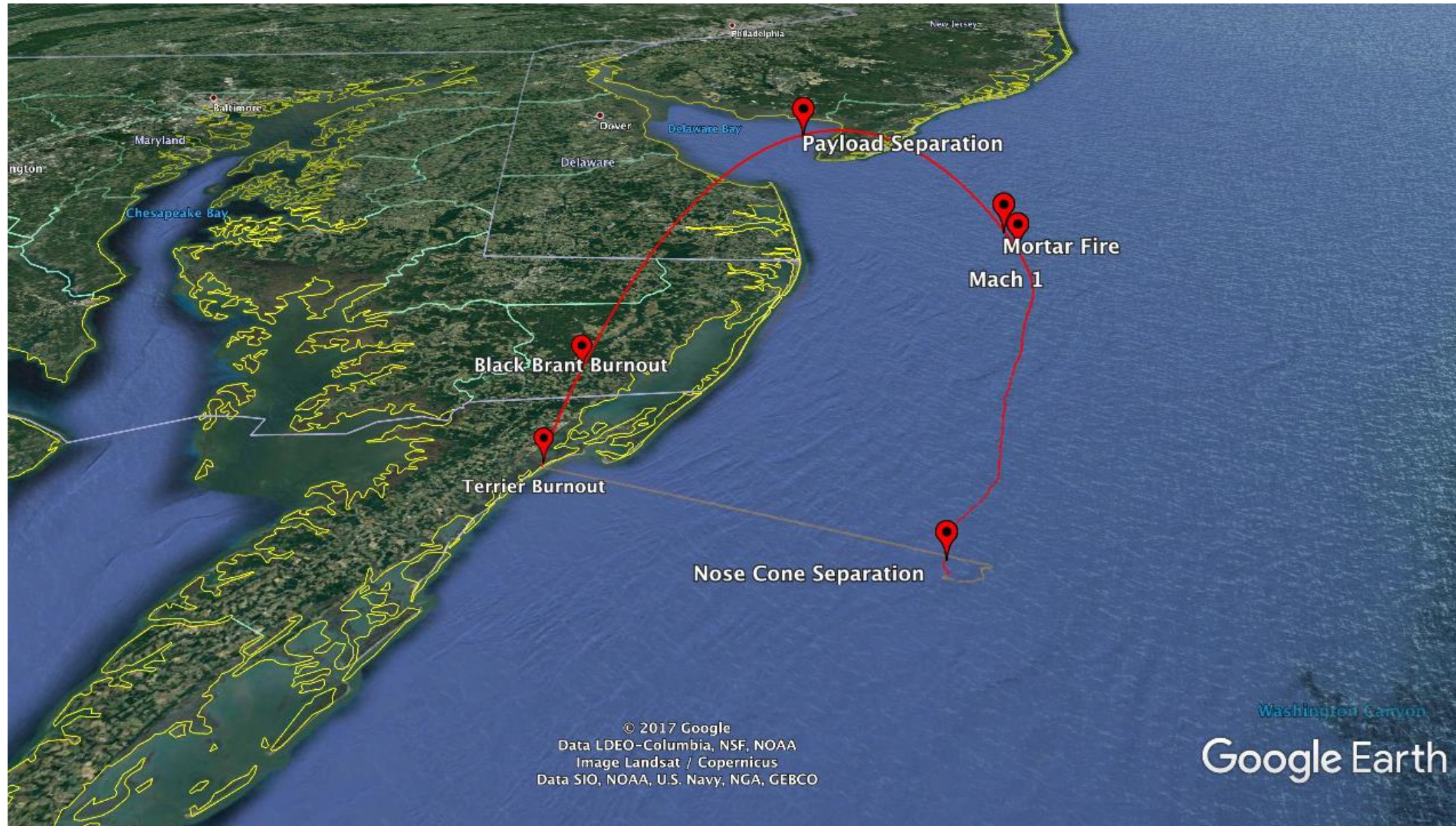
ASPIRE Test Architecture



- Rail-launched Terrier Black Brant
- Spin-stabilized at 4 Hz
- De-spin after 2nd stage burnout
- Mortar-deployed full-scale DGB parachute
- Cold gas attitude control system active from payload separation to before mortar fire
- Recovery aids:
 - Foam provides buoyancy
 - Nosecone ballast (for aerodynamic stability) is jettisoned before splashdown
- Payload mass:
 - Launch: 1268 kg
 - Post-separation: 1157 kg
 - Splashdown: 495 kg



Flight Overview



Flight Overview



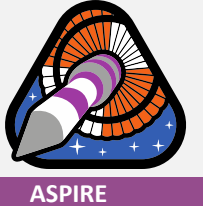
Flight Overview



ASPIRE



Flight Overview



Flight Overview



ASPIRE



Flight Overview



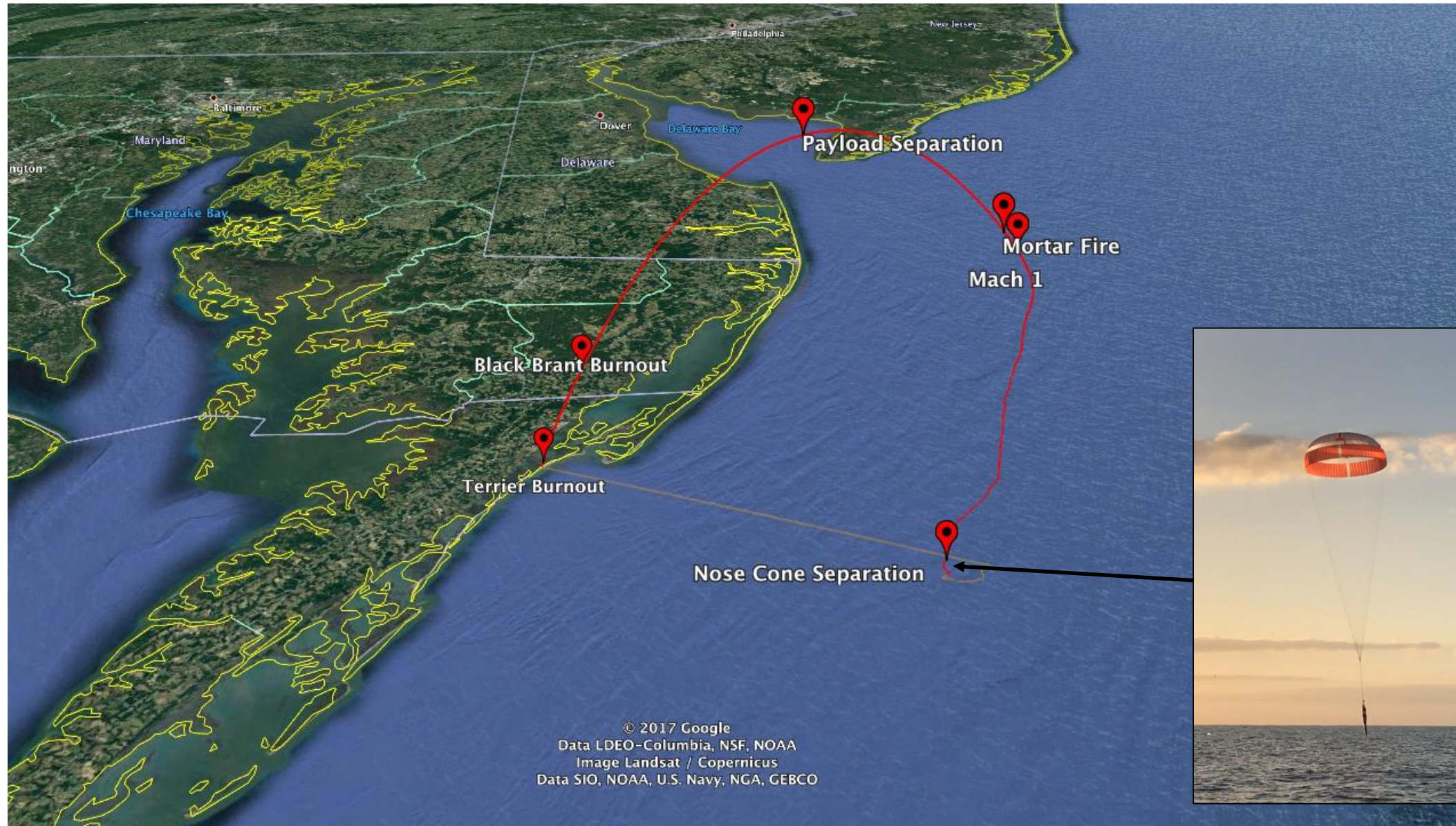
ASPIRE



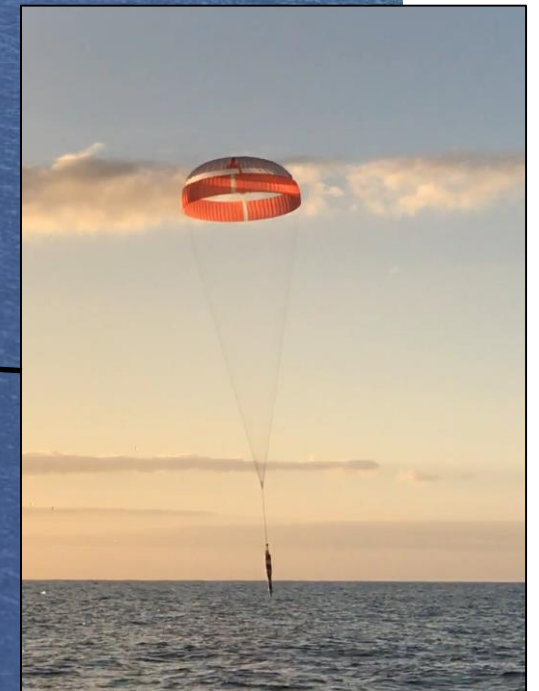
Flight Overview



ASPIRE



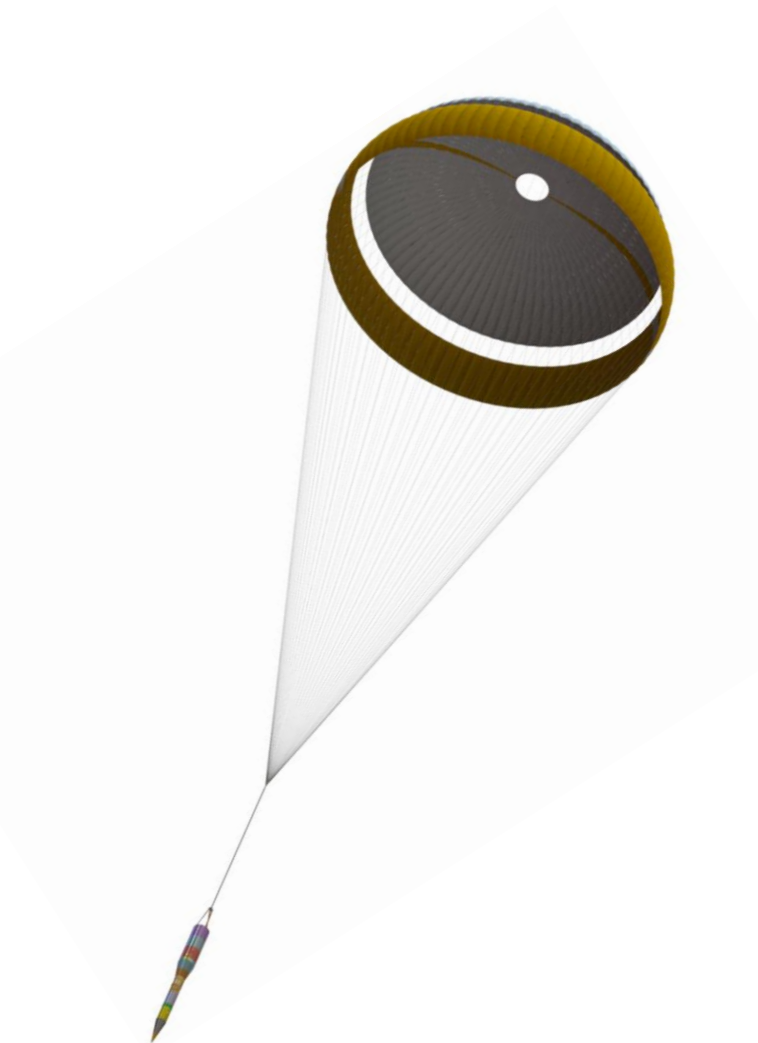
Photograph
courtesy of
Thomas Reed



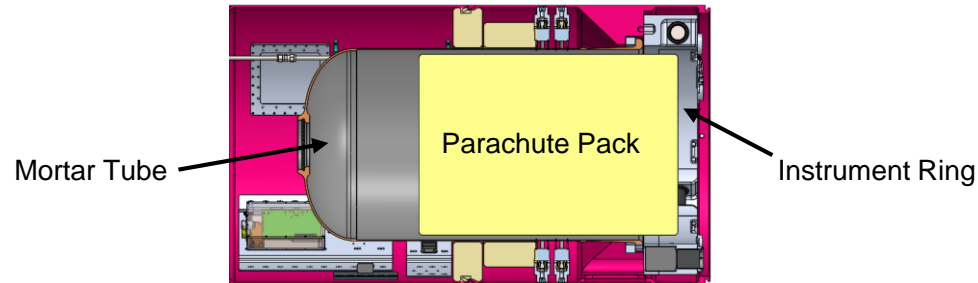
Test two full-scale mortar-deployed DGBs:

- MSL built-to-print
- Strengthened version of MSL DGB with a stronger broadcloth

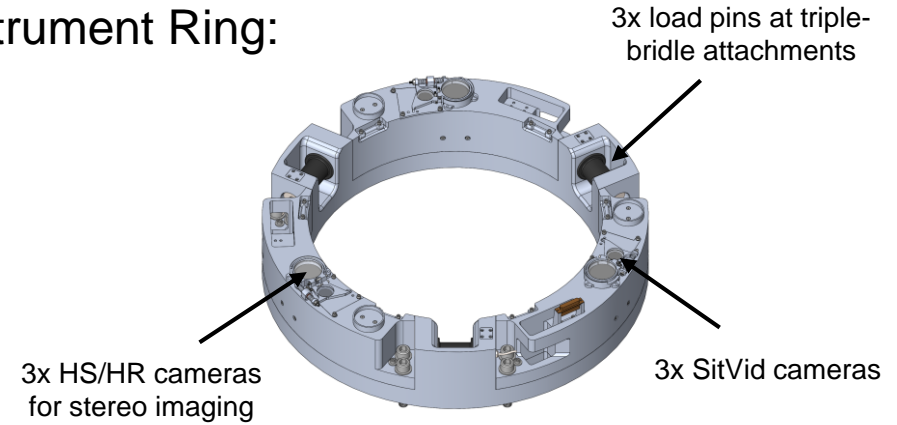
	MSL built-to-print	Strengthened
D_0	21.35 m	21.45 m
SL length	37.0 m (1.73 D_0)	36.44 m (1.70 D_0)
Riser length	7.05 m	7.78 m
Geometric Porosity	12.5%	12.5%
No. of gores	80	80
SL line material	2100 lb Technora	3500 lb Technora
Band fabric	PIA-C-7020 Type I	Custom nylon Heathcoat Ltd. (1.86 yd/oz, 100 lbf/in)
Disk fabric	PIA-C-7020 Type I (skirt)/Polyester 8860 (crown)	
Radials	2100 lb Technora	3500 lb Technora
Mass	49.8 kg	75.4 kg
Fabric permeability	100 cfm	90 cfm



Experiment section:



Instrument Ring:



- Additional on-board instrumentation:
 - GLN-MAC IMU
 - GPS
 - C-band transponder (radar tracking)
- Meteorological instrumentation:
 - 3x meteorological balloons carrying Radiosondes: temperature, density, winds to 35 km
 - 2x SuperLoki rockets w/inflatable ROBIN spheres: temperature, density, winds for 30 - 60km
- Allow reconstruction of:
 - Parachute loads
 - Conditions at parachute deploy (Mach, dynamic pressure, angle of attack)
 - Parachute shape & position

Acknowledgements



- The ASPIRE team at JPL, Langley Research Center, Wallops Flight Facility & Ames Research Center

